

## OVERLAY VIEW METHOD AND SYSTEM FOR REPRESENTING NETWORK TOPOLOGY

The present invention relates to a method and system for representing and maintaining complex telecommunication network layouts, and in particular to the selected display of distinctive network subsets.

### BACKGROUND OF THE INVENTION

Global networks are common to all of today's telecommunication systems, wherein various data, optical, and wireless devices can be interconnected by a series of individual local networks. A global network generally consists of nodes and links, which describe the network topology, and associated attributes, which comprise the network data. The nodes and links may represent physical objects located in a geographical region, or non-physical objects such as software elements. The attributes can include basic measurements such as router intercommunication concerning a number of packets and web page access frequency, or computed aggregates such as average link utilization and number of address sites within a specified geographical region. The associated attributes may be static, such as link capacities, or time varying, such as network loading throughout a specified time period.

Today's telecommunication networks involve ever richer and more detailed information facets, which can require increasingly complex network management systems. These management systems now include such modelling concepts as management structures, routes and paths, and/or logical verses physical topologies. Furthermore, these systems must manage the transmission of data traffic, including voice, video, and data, and other information over a variety of transmission mediums, such as wireless, copper, and fibre optic lines. In addition, the management systems are also typically utilised in managing network growth and/or modification as the network evolves.

1 As telecommunication networks become increasingly complex, it becomes evermore  
2 important to monitor and maintain the various devices present on the network and their  
3 interconnections. These management systems depend on an adequate model representation of  
4 the connections between devices to support management tasks, such as configuration, route and  
5 path analysis, line or node failure detection, and other associated problem solving activities. A  
6 further issue in network management is network layout, which is an intensive and extensive  
7 process wherein each network item is carefully mapped, physically and logically, to facilitate  
8 differential and selectable item representations. Therefore, an important feature of network  
9 management systems is to assist network managers to differentiate the various connected devices  
10 and links, and to select them in a systematic fashion to effectively explore the model  
11 representation of the desired network. This differentiation can include the recognition of the  
12 element information subsets inside a combined network view, such as management structure,  
13 path, or route.

14  
15 Accordingly, network interfaces that provide effective displays for representing network  
16 information are commonly used in network management systems, network provisioning systems,  
17 operation support systems, and numerous other applications. These displays can represent the  
18 network either logically or physically on a graphical user interface (GUI). The GUI can  
19 represent the network as a series of nodes connected by links, represented logically as a group of  
20 logical entities communicating through logical communication links, or as a group of physical  
21 devices located in physical locations connected by physical cables. A further GUI representation  
22 can be physical devices connected by logical communication links. Typically, the logical  
23 topology of a network does not correspond exactly to the physical topology. For example, a  
24 single physical device may constitute a plurality of logical entities or, similarly, a single physical  
25 cable may carry signals for a plurality of logical communication links. Accordingly, when  
26 exploring the representation of network configurations, it is desirable that the network manager  
27 can differentiate between the various links and attributes, and can select them in a systematic  
28 way to consider them in isolation or to compare them selectively.

1 Most network information in current management systems is permanently displayed  
2 inside the combined network view. The network view normally provides the total number of  
3 attached nodes and links as a combined view on the GUI. However, experience has shown that  
4 this single view is only practical in maintaining networks with a limited number of segments and  
5 associated nodes. Accordingly, as more connections are represented in the network along with  
6 their attributed information sets, this architecture can create a confusing structure of overlapping  
7 links and nodes crossing in all directions. This can cause problems in distinguishing between  
8 specific adjacent attached network elements, in identifying a desired node, and in selecting  
9 specific network items contained in the GUI display. Consequently, the topology and connection  
10 logic can get lost in a graphical chaos, which can increase the amount of time the network  
11 manager must spend in analysing the network. Furthermore, the nodes and associated links can  
12 be partially occluded or completely hidden from view, which can make the visual clutter more  
13 acute and tends to provide network representations that are visually cluttered, complex, and  
14 difficult to read and use.

15  
16 One solution presently used in the art is that of multiple view network management  
17 software. This technique represents network configurations through multiple associated views,  
18 wherein the representation of desired sets/subsets of information are treated in a series of  
19 separate views. Each of the desired sets/subsets are displayed simultaneously in separate  
20 windows, where the content of a single window can be refreshed to represent the individual  
21 views. The network manager can then view descriptive information of each of the attached  
22 segments of the separate views in order to manage the network configuration. However, network  
23 managers must navigate these multiple views by browsing through them in sequence, wherein  
24 the success of this approach depends heavily upon the user's short-term visual memory.  
25 Accordingly, this technique quickly becomes tedious and error prone as the complexity of the  
26 initial view and of the related desired views increases, as well as when the number of windows  
27 exceeds a threshold for simultaneous display on a single display.

28  
29 The above described multiple view management systems attempt to provide an improved  
30 method of viewing different desired sets of details, contained within the combined network view,

1 that can be circumstantially useful when separated but confusing if displayed in a single  
2 combined network view. However, it has been found that the value of the subsets of information  
3 is often revealed when they are considered in relation to one another. Accordingly, in multiple  
4 view network management systems, this necessary contextual information can be lost or  
5 otherwise confused when the combined network view is split up into adjacent multiple subset  
6 views.

7  
8 Another disadvantage of current telecommunication network management systems is that  
9 isolation of specific subsets contained in the combined Network view can be difficult, even more  
10 so when the reference network or the subset information is overly dense and complex, or when  
11 one is not familiar with these structures. Typically, network managers have to refer to some  
12 external list of elements composing the subset they seek and locate these in the combined  
13 network view. Each time an element is located, the network manager typically memorises the  
14 elements position to progressively compose a mental image of the subset in context with the  
15 combined network view, even when the identified elements are placed in separate multiple view  
16 representations.

17  
18 A further disadvantage in current network management systems is the mapping of logical  
19 and physical topologies, since the actual network can support various combinations of multiple  
20 topology subsets. The correspondence between the physical and logical topology subsets can be  
21 very complex and difficult to represent inside the combined network view. For example, the  
22 termination of a logical link between two logical devices may indicate a hardware error in a  
23 physical device. However, before the error can be identified and repaired, the physical device  
24 corresponding to the logical device must be determined. Since this correspondence does not  
25 always exist in a one to one relationship between logical and physical devices, this determination  
26 may not be straightforward in its implementation. In addition, a logical map typically identifies  
27 logical entities by logical addresses or identification numbers, wherein these addresses generally  
28 do not convey information about the physical location of the physical device corresponding to  
29 the logical entity.

1 A further disadvantage with present network management systems is in the representation  
2 of multiple technologies, which is typically condensed inside a common visual language for  
3 representing the technology specific information in the combined Network view. Therefore,  
4 multiple technology views of combined Network views can preclude the simultaneous use of  
5 multiple specific technology visual representations for traffic status, such as the SONET  
6 protection and switching traffic display visual representation, for different network elements.

7  
8 It is an object of the present invention to provide a system and method for representing  
9 telecommunication network layouts in order to obviate or mitigate some of the above-mentioned  
10 disadvantages.

## 11 12 SUMMARY OF THE INVENTION

13  
14 The present invention is directed to a method and system for a telecommunication  
15 network management tool to represent a combined telecommunication network layout, including  
16 a plurality of distinct network entities related to one another by a variety of attributes. A user  
17 interface is used for customizing a display of a base model representation, of the  
18 telecommunication network layout, through a selection of parameters to help a system manager  
19 systematically navigate the distinct network entities and associated attributes of the selected base  
20 model representation. An overlay view selector is used for affecting the display content of the  
21 representation on the user interface. The view selector contains a plurality of presentation modes  
22 for customizing the presentation of desired elements selected from the base model  
23 representation. Presentation of the selected network elements includes an information overlay  
24 subset displayed over a reference view, which helps the user to maintain the information overlay  
25 subset in context of the combined telecommunication network layout. The network management  
26 tool can be used to select and highlight specific network entities in context to help increase  
27 network manager efficiency in network layout and maintenance.

28  
29 According to one aspect of the present invention there is provided a telecommunication  
30 network management tool for visually distinguishing a selected telecommunication information

1 subset related to a selected telecommunication network layout. The tool comprises a user  
2 interface for assembling an altered representation of the network layout through a selected  
3 parameter. The user interface co-ordinates the display of the representation on a display. The  
4 tool also has a view selector coupled to the user interface for specifying the information set and a  
5 reference view, the reference view comprises a data subset contained in the network  
6 configuration. The tool also has a display controller coupled to the user interface for combining  
7 the information subset and the reference view to generate the representation according to the  
8 selected parameter, wherein the selected parameter affects the display content of the  
9 representation which provides a visual distinction between the selected information subset and  
10 the reference view of the representation.

11  
12 According to a further aspect of the present invention there is provided a method for  
13 visually distinguishing a selected telecommunication information subset related to a selected  
14 telecommunication network layout. The method comprises the steps of: selecting a data set  
15 representing the selected network layout; specifying a selected parameter for providing the  
16 selected information subset and a reference view, the reference view comprises a data subset  
17 contained in the data set representing the selected network; combining the information subset  
18 and the reference view for assembling an altered representation according to the selected  
19 parameter; and displaying the altered representation on a display; wherein the selected parameter  
20 affects the display content of the altered representation which provides a visual distinction  
21 between the selected information subset and the reference view of the representation.

22  
23 According to a still further aspect of the present invention there is provided a computer  
24 program product for visualizing a selected telecommunication information subset related to a  
25 selected telecommunication network layout. The product comprises: a computer readable  
26 medium; a user interface module stored on the medium for assembling an altered representation  
27 of the network layout through a selected parameter, the user interface module for co-ordinating  
28 the display of the representation on a display; a view selector module coupled to the user  
29 interface module for specifying the selected information subset and a reference view, the  
30 reference view comprises a data subset contained in the network layout; and a display controller

1 module coupled to the user interface module for combining the selected information subset and  
2 the reference view to assemble the representation according to the selected parameter; wherein  
3 the selected parameter affects the display content of the representation which provides a visual  
4 distinction between the selected information subset and the reference view of the representation.  
5

## 6 BRIEF DESCRIPTION OF THE DRAWINGS

7  
8 These and other features of the preferred embodiments of the invention will become more  
9 apparent in the following detailed description in which reference is made to the appended  
10 drawings wherein:

11 **Figure 1** shows a system for representing network layout;

12 **Figure 2** displays a combined network view of the system of Figure 1;

13 **Figure 3** is a modified display of the combined network shown in Figure 2;

14 **Figure 4a** is a further embodiment of the system of Figure 1;

15 **Figure 4b** is a further embodiment of the system of Figure 1;

16 **Figure 5** is a still further embodiment of the system of Figure 1;

17 **Figure 6** a still further embodiment of the system of Figure 1; and

18 **Figure 7** presents a flowchart for operation of the system of Figure 1.  
19

## 20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

21  
22 Referring to Figure 1, a telecommunication network management tool 10 is coupled in  
23 series with a global database 5, a data collector 4, and one or more telecommunication network  
24 layouts 3, such as but not limited to a SONET network. The telecommunication network layout  
25 3 is typically a set of interconnected communication devices or nodes 14 interconnected by links  
26 or segments 13, both physical and logical, which permit communication of data from one point  
27 in the telecommunication network layout 3 to another. Some examples of the telecommunication  
28 network layouts 3 are various technology types, including but not limited to; Synchronous  
29 Optical Networks (SONET), Synchronous Digital Hierarchy (SDH), Dense Wave Division  
30 Multiplexing (DWDM), Asynchronous Transfer Mode (ATM) Networks, and networks

1 comprising a mixture of these technologies. The telecommunication network layout 3 can also  
2 include the Internet, networks of Microwave and Antenna Base Stations, and Satellite Networks.  
3 Regardless of the specific type, the telecommunication network layout 3 comprises a specified  
4 number of the communication devices 14 and the links 13, which each having a set of defined  
5 network features that can be collectively referred to as a telecommunication information set 16.  
6 For example, an ATM Network includes communication devices 14 and interconnections or  
7 links 13 that may be used for a particular customer and/or service. In other telecommunication  
8 network layouts 3, the communication devices 14 and links 13 may include such things as  
9 routers, antenna base stations, or interconnected segments that range from copper wire to fibre  
10 optic cable to microwave links.

11  
12 The network management tool 10 includes a display 11 for helping a network manager to  
13 monitor and maintain the communication devices 14 and links 13 of the telecommunication  
14 network layout 3. The display 11 includes a Graphical User Interface (GUI) 12 that provides the  
15 network manager with access to a run time object base model representation 18a of the  
16 telecommunication network layout 3 (see Figure 2) on the display 11. The base model  
17 representation 18a represents a systematic display of the network layout 3. It should be noted  
18 that this systematic display typically contains a minimal number of devices 14 and links 13 and  
19 their respective attributes, also referred to as a standard reduced subset of the information set 16,  
20 so that the base model representation 18a is readable by the network manager. Therefore, the  
21 systematic display of the base model representation 18a typically cannot simultaneously  
22 represent all of the data contained in the information set 16, as desired for different aspects of  
23 network planning and maintenance, since the simultaneous detailed display of the information  
24 set 16 data usually results in a cluttered and unreadable presentation of the base model  
25 representation 18a on the display 11.

26  
27 The network management tool 10 can be adapted to perform two functions for operating  
28 the display 11. Firstly, it can present the GUI 12 on the display 11 to enable the presentation of  
29 an altered version of the base model representation 18a with the communication devices 14, links  
30 13, and attributes to the manager in a coherent manner, as well as to enable the receipt of



1 instructions from the manager through a user input device 8 to provide for alteration instructions.  
2 Secondly, the network management tool 10 can co-ordinate the transfer of the information set 16  
3 for storing in a local database 6 of the network management tool 10, and to perform processing  
4 on the information set 16 stored in the local database 6 in accordance with the instructions  
5 received from the manager through the user input devices 8 and a computer readable medium 9.  
6 This processing is used to put the information set 16 into the base model representation 18a in a  
7 desired format by the network manager for display on the display 11. The network management  
8 tool 10 thereby provides altered telecommunication overlay views 18b, c, d, e, f, (see additional  
9 figures) to help enable the efficient representation and exploration of the telecommunication  
10 network layout 3, through the use of selectively displayed and selected portions of the  
11 telecommunication information set 16.

12  
13 The data collector 4 in communication with the network management tool 10 is  
14 preferably capable of collecting the information sets 16 concerning the communication devices  
15 14 and links 13 contained within the telecommunication network layout 3. These information  
16 sets 16 can include, for example, logout data, element state, configuration data, connectivity  
17 data, categorisation data, and status and performance information. The possible status  
18 information set 16 can include a warning flag, a failure notice, another alarm indication, and an  
19 "OK" flag. The possible performance information set 16 can include signals comprising  
20 particular network entities error rates and percent utilization. The information sets 16 can be  
21 stored in the global database 5 as status and performance attributes respectively of the  
22 communication devices 14 and links 13, which is then accessed by the network management tool  
23 10 for storage in the local database 6.

24  
25 The global database 5 receives and stores the information set 16 from the data collector 4.  
26 The entry of this information set 16 to the global database 5 could be made by a central operator  
27 at the global database 5, or alternatively could be communicated through the telecommunication  
28 network layout 3 and the data collector 4 by operators at remote locations, such as customer  
29 sites. Alternatively, this information set 16 may be entered into the global database 5 by having  
30 the communication devices 14 and links 13 contained in the telecommunication network layout 3

1 directly communicate with the global database 5. This information sets 16 can represent a  
2 substantially real time status of the communication devices 14 and links 13 contained within the  
3 telecommunication network layout 3, as available to the network management tool 10 to provide  
4 stable information sets 16 with minimized delay times. However, it should be noted that  
5 information sets 16 containing historical network status could also be stored if desired.

6  
7 The computer system of network management tool 10 preferably comprises a network  
8 management processor 7 coupled to the global database 5. The network management processor  
9 7 is also coupled to the display 11 and to the user input devices 8, such as a keyboard, a mouse,  
10 or other suitable devices. If the display 11 is touch sensitive, then the display 11 itself can be the  
11 user input device 8. The computer readable medium 9 is coupled to the network management  
12 processor 7 for providing instructions to the network management processor 7 to perform steps  
13 or algorithms related to operation of the network management tool 10. The network  
14 management processor 7 can also act as a display controller for co-ordinating various  
15 combinations of the content included in the information set 16 for displaying the altered  
16 representation of the base model representation 18a (see Figure 2) on the display 11. The  
17 computer readable medium 9 can include hardware and/or software such as, by way of example  
18 only, magnetic disks, magnetic tape, optically readable media such as CD ROMs, and  
19 semiconductor memory such as PCMCIA cards. In each case, the computer readable medium 9  
20 may take the form of a portable item such as a small disk, floppy diskette, cassette, or it may take  
21 the form of a relatively largely or immobile item such as a hard disk drive, solid state memory  
22 card, or RAM provided in the computer system of the network management tool 10. It should be  
23 noted that the above listed examples of the computer readable medium 9 can be used either alone  
24 or in combination.

25  
26 The local database 6 is coupled to the network management processor 7 to receive and  
27 store portions of the information set 16 corresponding to the communication devices 14 and links  
28 13 within the telecommunication network layout 3 of interest, i.e. a user selected overlay  
29 information subset 40 (see Figure 3) or snapshot of the information set 16 contained in the global  
30 database 5. The data of the information set 16 preferably consists of a direct containment

1 hierarchy of the communication devices 14 and links 13, corresponding attributes for each of the  
2 network regions of interest, and an identification of where in each containment hierarchy each  
3 communication device 14 and link 13 is located. In some embodiments, the communication  
4 devices 14 and links 13 could be located in more than one location with the containment  
5 hierarchy, for example, if the communication devices 14 and links 13 are shared between two  
6 different customers.

7  
8 The information set 16 can be manually inputted to the local database 6 by operators  
9 using the user input devices 8, or can be downloaded in either "on" or "off" line modes from the  
10 global database 5. In the end, the local database 6 preferably maintains a network layout groups  
11 50 structure (see Figure 5) for each of the attribute layer containment hierarchies, with a  
12 particular network communication device 14 or link 13 being included in one or more groups.  
13 The network layout groups 50 define the base model representation 18a, which can be used to  
14 manage the telecommunication network layout 3 of interest. Alternatively, the local database 6  
15 could maintain a list of the communication devices 14 and links 13 within the telecommunication  
16 network layout 3 of interest, along with a list of corresponding network features or attributes  
17 represented by the information set 16 that are associated with the communication devices 14 and  
18 links 13.

19  
20 Referring to Figure 2, the network management tool 10 includes the GUI 12 on the  
21 display 11, which contains the base model representation 18a. In the present example, the  
22 telecommunication network layout 3 is represented as a series of nodes 20 coupled by  
23 interconnection segments 22 for portraying the generic communication devices 14 and links 13.  
24 The base model representation 18a is presented on a background 24 of the GUI 12 and can be  
25 used to portray a visual representation of the selected actual telecommunication network layout  
26 3, shown in Figure 2 as the base model representation 18a. The GUI 12 also contains a control  
27 panel providing an overlay view selector 26 for allowing the network manager to control or  
28 otherwise alter the visual presentation of the base model representation 18a. These alterations  
29 can be used to add or delete the nodes 20 and segments 22 in a predetermined format as desired  
30 to generate altered overlay views 18b, c, d, e, and f, further described below.

1  
2 The overlay view selector 26 has three sections 28, 30, 32 for providing various  
3 information to the manager about the visual content of the base model representation 18a. The  
4 section 28 includes the number of alarm counts that are contained in both the shown and hidden  
5 parts of the telecommunication network layout 3. Section 30 has two toggle boxes 34 for  
6 controlling the presentation of, such as but not limited to management views, connectivity traces,  
7 alarm conditions, traffic, performance, service alarms, and other desired attributes contained in  
8 the information set 16 of the selected corresponding nodes 20 and segments 22. Section 32  
9 contains the toggle boxes 34 for various nodes 20 and segments 22 contained within the topology  
10 layers present in the base model representation 18a, such as but not limited to Circuit Switching,  
11 IP, ATR/FR, SDH/SONET, Optical, Logical, and Physical structures. Section 32 also contains a  
12 “grayed out” indicator 36, which by way of example only shows the manager that any toggle box  
13 34 devoid of a check indicator 38 is either not present or shown in a ghosted view as further  
14 explained below.

15  
16 Referring to Figure 3, an altered overlay view 18b of the base model representation 18a is  
17 shown, which comprises a selected telecommunication information overlay subset 40 displayed  
18 over a telecommunication information subset or reference view 42. These subsets 40, 42 can be  
19 selected from the total information set 16 representing the telecommunication network layout 3.  
20 In the present example, the information overlay subset 40 represents an extracted or isolated  
21 Management view of the layers containing only IP, ATR/FR, SDH/SONET, and Logical  
22 components of the base model representation 18a. The components of Circuit Switching and  
23 Optical have been removed from the Management view, as noted by the lack of check indicators  
24 38 in their respective toggle boxes 34 of section 32. Accordingly, the remainder of the base  
25 model representation 18a is shown as the reference view 42 in a grayed out or ghosted view  
26 format, thereby helping to relieve some of the visual clutter inherent in the base model  
27 representation 18a. Accordingly, the overlay view 18b can enable the manager to isolate the  
28 desired information overlay subset 40 from the base model representation 18a, but still maintain  
29 the presence of the reference view 42 to provide desired contextural secondary information.  
30 Accordingly, the detection and analysis of the information overlay subset 40 can become a pre-

1 attentive visual cognitive process for the manager, while minimizing the visual load of the base  
2 model representation 18a.

3  
4 One aid to minimizing the visual load of the base model representation 18a, while  
5 maintaining context, is the use of alternative visual characteristics for the reference view 42 that  
6 are distinct from the selected information overlay subset 40. Accordingly, the color, various  
7 lighter shadings, and transparent presentation formats of the selected information overlay subset  
8 40 and remaining data subset of nodes 20 and segments 22 of the reference view 42 are used by  
9 the GUI 12 to help the network manager to identify or distinguish particular portions contained  
10 in, or in addition to, the base model representation 18a. A color coding scheme of the nodes 20  
11 and segments 22 on the display 11 can be such as but not limited to; red, orange, and cyan  
12 yellow for various alarm states; green for IP segments 22 and nodes 20; mauve for optical or  
13 SONET segments 22 and nodes 20; yellowish green for switch nodes 20; and brown for wireless  
14 segments 22 and nodes 20. The target information overlay subset 40 is preferably represented as  
15 a saturated color, and the associated reference view 42 is preferably represented as a lighter  
16 shade or diluted version of the saturated color or in a substantially transparent or ghosted format.  
17 It is recognized that other color coding schemes and/or line types can be used to represent the  
18 various nodes 20 and segments 22 on the display 11.

19  
20 Referring to Figure 4a, a further embodiment of the present invention shows an overlay  
21 view 18c containing the selected information overlay subset 40 in solid lines and the remaining  
22 reference view 42 in cross hatched lines. The display format of the overlay view 18c is a logical  
23 management view of SONET architecture showing only SDH/SONET nodes 20 and segments  
24 22. It should be noted that the nodes 20 are presented by individual nodes A, B, C, D, E, F, G,  
25 and H. Accordingly, only the SDH/SONET and logical toggle boxes 34 are indicated in the  
26 section 32 of the overlay view selector 26. It should be noted that the non-selected nodes 20 and  
27 segments 22 listed in the section 32 are still shown in a less obvious or more subtle fashion for  
28 the reference view 42, for contextural purposes. However, the non-selected nodes 20 and  
29 segments 22 could also be excluded from view, or a subset thereof, from the overlay view 18c if  
30 desired to further minimize the visual clutter of the selected information overlay subset 40.

1  
2 It should be noted that the GUI 12 could contain an additional overlay selector panel 44  
3 detailing the type of overlay modes 45 selected for generation of the overlay view 18c. Block  
4 indicators 46 in the overlay selector panel 44 are used to indicate to the manager the overlay  
5 mode 45 selected. In addition to the overlay modes 45, the overlay selector panel 44 also  
6 contains a tool section 48 for providing selection and simultaneous display of the various  
7 available technology specific visual representations 49, such as but not limited to the SONET  
8 protection and switching language. These specific visual representations 49 can be used to  
9 overlay primary and/or secondary state information on the overlay view 18c, so as to provide  
10 more versatility in representing the information set 16 for visual indication of each network  
11 object such as nodes 20 and segments 22. It should be also noted that the overlay view 18c is  
12 displayed in a logical topology.

13  
14 Referring to Figure 4b, an augmented view 18d of the overlay view 18c is presented  
15 wherein the display type of the selected overlay subset 40 has been changed to a physical overlay  
16 topology, as indicated in section 32. It should be noted that in addition to the change in spatial  
17 location of physical device H in regard to the logical entity H, the segments 22 between the  
18 devices A, B, C, D, E, F, G, H have also changed in their corresponding dependencies.  
19 Furthermore, the reference view 42 remains displayed in the logical format, however a  
20 corresponding change to physical topology could also be selected if desired. Accordingly, the  
21 conversion from logical to physical topology of the selected information overlay subset 40 can  
22 be used to identify physical relationships and problems, which may be affecting the logical  
23 operation of the telecommunication network layout 3 represented by the information overlay  
24 subset 40. It should be recognized that various other combinations of overlay modes 45,  
25 technology specific visual representation 49, and selected devices and topologies in section 32  
26 can be used by the manger to assemble the altered version, augmented view 18d, of the base  
27 model representation 18a. These other combinations can be used for the display 11 so as to  
28 contain the secondary contextural information represented by the reference view 42 in a less  
29 obvious or more subtle selected format in relation to the selected overlay subset 40, so as to  
30 assist in perceiving the most relevant way to reveal trends and co-relations inherent in the base

1 model representation 18a. This visualization procedure of the network management tool 10 can  
2 thereby help to relieve some of the visual clutter inherent in the base model representation 18a,  
3 which otherwise may be difficult to detect and interpret by the network manager.

4  
5 Referring to Figure 5, another embodiment of the network management tool 10 includes a  
6 window on the GUI 12 referenced as an application launch menu 47. The launch menu 47  
7 provides a way of launching the network management tool 10 from a regular network  
8 management application such as Nortel Networks Preside Application Platform. The launch  
9 menu 47 includes the network layout groups 50. The network layout groups 50 includes an  
10 associated series of individual network groups 52, contained within the telecommunication  
11 network layout 3, arranged in a hierarchical structure. These network groups 52 can also be  
12 organized in the launch menu 47 according to other user definitions or structures as desired. The  
13 network groups 52 can be defined according to a number of attributes including; network region,  
14 technologies, operator, customers, and combinations thereof. The launch menu 47 can also  
15 contain alarm banners 51, which display an alarm count for each of the associated network  
16 groups 52. The alarm count includes alarms for sub-groups of the network groups 52, when these  
17 sub-groups are not displayed in the launch menu 47 because the sub-groups are located in closed  
18 sections of the network layout groups 50 hierarchy displayed in the launch menu 47.

19  
20 Upon selection of one of the network groups 52, indicated for example as a highlighted  
21 row 54 adjacent to a cursor 56, the selected groups 52 can be displayed as the target information  
22 subset 40 in a resource browser window (not shown) on the GUI 12. The network manager can  
23 then select the node 20 of interest, indicated as MGG001, from the resource browser window for  
24 corresponding display in a management view window 48. The management view window 48  
25 provides for an isolated display of a management organization structure 58 controlling the  
26 selected node 20 of interest (MGG001). Accordingly, using this management view window 48  
27 shows the selected node MGG001 managing the associated nodes 20a, referred to as Metro  
28 Town, Crystal Beach, and Moonies Bay. These additional associated nodes 20a may not be  
29 contained within the selected network group 52, rather they can be contained by other network  
30 groups 52 of the network management structure 50, and/or in the global database 5 and obtained

1 by the network management tool 10 for supplementing the relational display shown the  
2 management view window 48 for the selected node MGG001. The network manager could also  
3 manually select other nodes 20 shown in the resource browser window (not shown), as contained  
4 in the selected group 52 and represented by the target information subset 40, for display in the  
5 management view window 48. It is recognized that alternatively, nodes 20 managing the  
6 selected node MGG001 could also be displayed in the network management window 48, if  
7 desired. It should be noted that the management organization structure 58 can be independent of  
8 the structure of the network layout groups 50, such that there can be multiple network layout  
9 groups 50 for the management organization structure 58.

10  
11 An alternative approach to display the management information, associated with the node  
12 20 of interest, is to assemble the overlay view 18e where the target information overlay subset 40  
13 containing the information management information would be displayed in context with the  
14 reference view 42. However, it should be noted that additional nodes 20a not contained within  
15 the reference view 42 would not be displayed using this approach.

16  
17 Referring to Figures 5 and 6, a further embodiment of the network management tool 10  
18 shows an augmented overlay view 18f with a set of specialized details 60 included in the selected  
19 information overlay subset 40, which are circumstantially useful, but would significantly reduce  
20 the overall usability of the base model representation 18a if they were displayed permanently.  
21 These specialized details 60 can include pre-defined telecommunication information sets 16  
22 having detailed technology specific visual representations 49 for primary state and secondary  
23 state information contained within the information set 16, which can be displayed over the  
24 reference view 42 upon selection in the overlay selector panel 44. The use of multiple specific  
25 visual representations 49 to generate the altered overlay views 18b, c, d, e, f can help the  
26 manager to consider the specialized details 60 in reference to a stable topology of nodes 20 and  
27 segments 22, and can avoid permanently cluttering the base model representation 18a with  
28 circumstantially useful information. Accordingly, the use of selected information overlay  
29 subsets 40 with specialized details 60, to provide the application of multiple technology specific  
30 visual representations 49 in parallel, can help the development of more versatile management



1 systems. Other specialized details 60 can also include but are not limited secondary  
2 management, historical performance and/or traffic data.

3  
4 Referring to Figure 7 for operation of the network management tool 10, the manager can  
5 select 100 the desired network groups 52 from the telecommunication network layout 3 to be  
6 displayed on the GUI 12. Accordingly, the corresponding information set 16 is either  
7 downloaded from the databases 5, 6 or retrieved by the data collector 4 and sent to the network  
8 management processor 7 at step 102. The manager then decides 104 whether the selected  
9 network groups 52 and corresponding content of information set 16 is in a suitable format for  
10 display of the base model representation 18a on the GUI 12, which can include predefined  
11 information overlay subsets 40 and corresponding reference views 42. These predefined  
12 information subsets 40, 42 could have been generated in a save mode in previous applications of  
13 the GUI 12 to represent the base model representation 18a. In addition, editing of the data  
14 content of the information set 16 at step 103 can be done by using the network management tool  
15 10 as an editing facility to layout the desired communication devices 14 and links 13. As the  
16 communication devices 14 and links 13 are constructed, they are assembled into the common  
17 GUI 12 display. The manager can use the network management tool 10 to construct the number  
18 and position of the nodes 20, the length and orientation of the segments 22, and assemble the  
19 corresponding attribute information set 16 related thereto. The manager can also choose the  
20 format of the background 24 to represent such as but not limited to specific topologies,  
21 geography, pre-defined or custom patterns, an abstract representation, or a saturated color. It is  
22 also recognized that traditional editing facilities could be used to edit the telecommunication  
23 network layout 3 prior to analyzing the edited versions by the network management tool 10.

24  
25 In the event the display format of the base model representation 18a is suitable, or a  
26 suitable pre-defined or saved custom format is available, the network management tool 10 then  
27 proceeds to automatically 106 display the selected information overlay subset 40 and  
28 corresponding reference view 42, if applicable, by using the network management processor 7 as  
29 the display controller. However, if the display format is not suitable 108 upon selection of the  
30 network groups 52, then the manager can use the overlay view selector 26 and selected

1 parameters, and corresponding additional overlay selector panel 44 if appropriate, for altering  
2 110 the base model representation 18a to highlight the selected information subset 40 in context  
3 with the reference view 42 obtained from the information set 16. This alteration procedure can  
4 use the attributes of the network management window 48 and preview function 112 of the launch  
5 menu 47, if desired. The altered overlay view 18b, c, d, e, f can include any desired selection of  
6 parameters for specific device layers, logical verses physical modes, color and/or ghost view  
7 distinction of the reference view 42 with respect to the selected information overlay subset 40,  
8 technology specific visual representations 49, and indication of management views and alarm  
9 status. The alteration can also include augmentation and/or overlay modes 45 of the selected  
10 information overlay subset 40 with respect to the reference view 42, as well as the addition of the  
11 specilized details 60.

12  
13       Once the selected information overlay and reference data subsets 40, 42 are displayed  
14 114 as the altered overlay view 18b, c, d, e, f, the network manager can analyse 116 the  
15 displayed overlay view 18b, c, d, e, f and update the time varying contents as desired. The  
16 display of the selected information overlay subsets 40 in the overlay views 18b, c, d, e, f, with  
17 the reference view 42, can be toggled on and off on demand of the manager, thereby allowing  
18 application of the overlay subsets 40 only when deemed relevant to the analysis at hand. In the  
19 event that further refinements 118 to the display format of the overlay view 18b, c, d, e, f are  
20 desired, the manager can either request 120 added or deleted data from the information set 16,  
21 and/or proceed to repeat the alteration procedure at step 104. Once the analysis is complete 122,  
22 the management task of the network management tool 10 is completed at step 124.

23  
24       In the event that the manager can determine all requirements from the presently displayed  
25 altered overlay view 18b, c, d, e, f, the manager can then stop 124 the analysis or can select an  
26 alternative base model representation 18a at step 100. Accordingly, operation of the network  
27 management tool 10 can help the manager to provide the selected information overlay subsets 40  
28 that can be removed when not needed to reduce visual noise, thus minimizing visual load.  
29 Furthermore, the network management tool 10 also facilitates the isolation of selected  
30 information overlay subsets 40 in the modified overlay view 18b, c, d, e, f to help reduce the

1 perceived complexity of the base model representation 18a, and the cognitive efforts required to  
2 perform this distinction of the selected information overlay subset 40. When displayed to enrich  
3 or otherwise augment the reference view 42, the selected information overlay subset 40 can be  
4 displayed showing only the minimum amount of extra visual elements desired at any one time.  
5 This system thus helps to restrict the density and complexity of the base model representation  
6 18a, as desired. Furthermore, the extra specialized details 60 can also be displayed in contrast  
7 with the reference view 42 to reduce the required complexity of the base model representation  
8 18a. These specialized details 60 can also help to reduce the cognitive efforts required to  
9 distinguish the selected information overlay subset 40, representing the specialized details 60,  
10 from the remaining elements of the base model representation 18a, represented by reference view  
11 42.

12  
13 It is recognized that the manager can construct simultaneous and alternate overlay views  
14 18b, c, d, e, f of the base model representation 18a on the GUI 12, for use in the detection and  
15 maintenance of elaborate network inter relationships, while maintaining contextural information  
16 therein. Accordingly, the selection of various information overlay subsets 40 and corresponding  
17 reference views 42 using the overlay view selector 26 can be implemented in various fashions  
18 depending upon the number of selected information overlay subsets 40 and the possible  
19 combination of these within, and external to, the base model representation 18a. Accordingly,  
20 this implementation can help provide the ability to visually isolate the selected information  
21 overlay subsets 40 in context from the combined information set 16 contained in the base model  
22 representation 18a.

23  
24 These selected information overlay subsets 40 can be generated from data typically  
25 internal or systematic to the standard reduced subset of the information set 16, which provides  
26 for a systematically displayed base model representation 18a. The overlay subsets 40 can be  
27 assembled from this standard reduced subset through the selection of various selected  
28 parameters, such as but not limited to the contents of section 30 for management views,  
29 connectivity traces, alarm conditions, traffic, performance, service alarms, and in section 32 for  
30 topology layers including circuit switching, IP, ATR/FR/SDH/SONET, optical, logical and

1 physical modes. Accordingly, the total information set 16 typically contains more network  
2 information than can be represented by displaying the base model representation 18a, otherwise  
3 an over-cluttered and unworkable display could result. Therefore, the base model representation  
4 18a is typically displayed initially using the standard reduced subset of the information set 16,  
5 before altered by the network manager through removal of material from the standard reduced  
6 subset or addition of material represented by the specialized details 60.

7  
8 The selected parameters can also include indicators 36 for providing alternate  
9 presentation schemes including grayed out or ghosted view formats, alternate colours, various  
10 shadings, and transparent presentation formats. The selected parameters can also include overlay  
11 modes 45, technology specific visual representations 49, as well as network regions 50, network  
12 configurations 52, and various display options 48 such as view alarms, connectivity trace  
13 display, and overlay management views. Alternatively, the information overlay subsets 40 can be  
14 augmented by including some specialized details 60 contained within the information set 16, but  
15 otherwise unusable for generating the display of the base model representation 18a. These  
16 specialized details 60 are typically external to the standard reduced subset of the information set  
17 16 used to systematically generate the base model representation 18a. Accordingly, these  
18 specialized details 60 can be requested by the network manager for inclusion in the overlay  
19 subset 40. It should be noted that the specialized details 60 preferably remain external to the  
20 standard reduced subset of the information set 16, and therefore only implemented upon request  
21 by the network manager to help minimize visual clutter of the overlay views 18b, c, d, e, f. The  
22 selected parameters can also include sets of specialized details 60 including secondary  
23 management, historical performance, and/or traffic data.

24  
25 It is further recognized that operation of the network management tool 10 can be  
26 provided by computer network representation software contained in the above described network  
27 management tool 10, as software and/or hardware modules represented by the computer readable  
28 media 9. It is further recognized that communication devices 14 and links 13, nodes 20, and  
29 segments 22 can also be referred to collectively as network entities or elements.

1           Although the invention has been described with reference to certain specific  
2   embodiments, various modifications thereof will be apparent to those skilled in the art without  
3   departing from the spirit and scope of the invention as outlined in the claims appended hereto.